1949 Thesis

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CONSTRUCTION + EVALUATION - DIAGNOSTIC TEST - MAP SKILLS - GRADES
10, 11, 12, COMPARED RESULTS - IDENTICAL TEST FOR GRADES 7, 8, 9.

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THE CONSTRUCTION AND EVALUATION OF A DIAGNOSTIC TEST ON MAP SKILLS FOR GRADES TEN, ELEVEN, AND TWELVE TO BE COMPARED WITH THE RESULTS OF AN IDENTICAL TEST FOR GRADES SEVEN, EIGHT, AND NINE.

Submitted by

William John Edgar

(B. S. in Ed., Bridgewater State Teachers College, 1941)

In partial fulfillment of requirements for
the degree of Master of Education

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ACKNOWLEDGMENTS

The writer wishes to express his appreciation to Mr. Franklin C. Roberts for his advice in preparing this thesis; and to Dr. Walter N. Durost for his aid on the statistics.

The writer also wishes to express his appreciation to Supt. of Schools, Richard B. Greenman, and to the Swansea teachers for their cooperation in administering the test.

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CHAPTER I

STATEMENT OF THE PROBLEM

The purpose of this thesis is to determine if the pupils of the tenth, eleventh, and twelfth grades are able to read maps, graphs, and charts better and more skillfully than the pupils of the seventh, eighth, and ninth grades, and, also, to see if the ability to read maps, graphs, and charts has any correlation with intelligence test scores. These questions are to be answered by the construction and administration of a test on map skills to these grades. The resulting data will be analyzed and comparisons shall be made.

The question of the relative ability in map reading of the upper and lower secondary grades arises because of the fact that map skills are taught in the elementary schools. According to Littlefield these skills should have been acquired before leaving grade six.1/ Will the seventh, eighth, and ninth graders do better because they have more recently learned these skills, or will the maturity and experience of the tenth, eleventh, and twelfth graders enable them to overcome the handicap of increased learning distance?

1/ Harold Wood Littlefield, "The Construction and Evaluation of a Diagnostic Test on Map Skills for Grades Six, Seven, and Eight," unpublished Ed.M. Thesis, Boston University, School of Education, 1947.

Research has been confined to the study of map skills at the elementary and junior high school levels. Social studies teachers of the secondary schools take for granted that these skills have been learned. This is an assumption that men drafted into the Armed Forces did not bear out. Hutter states that after testing a number of Air Corp Cadets from all sections of the country a large portion of the young men were weak in the ability to use maps. 1/

Have the schools failed to do their job? Renner says:

> The map is by far the most important of all visual instruments in education, much more important than films. It holds this rank because of its priority in concept building, and because of its variety of uses. Nevertheless, it is the most neglected of all the so-called visual aids. 2/

If the schools have failed, where is the breakdown occurring? Are map skills taught too early? Are map skills not taught thoroughly at the elementary school level? Are teachers of the junior and senior high schools assuming that because the skills have been taught, time does not have to be spent in reviewing and adding to these skills? In this thesis it is hoped that further information about map skills will be brought to light and perhaps a partial answer to some of these questions achieved.

1/ H. K. Hutter, "Mistakes Made in Geography by Beginning Air Corp Cadets," Journal of Geography, Volume 43:108-111, March, 1944.

2/ G. T. Renner, "The Map as an Educational Instrument," Social Education, Volume IV, Number 1, 1940, p. 477.

CHAPTER II

REVIEW OF RESEARCH

In 1947, Harold W. Littlefield[1] constructed and gave a test to pupils in grades six, seven, and eight. Its purpose was to reveal the ability of sixth, seventh, and eighth grade children to use map reading skills. The test that Littlefield gave covered the following:

1. Recognition of direction.
    a. Ability to know direction as expressed in terms of the cardinal and mid-cardinal points.

2. Recognition of scale.
    a. Ability to measure distance on maps of different scale and different projection.

3. Recognition of latitude and longitude.
    a. Ability to locate and designate points.
    b. Ability to measure distance by changing degrees of latitude to miles.
    c. Ability to associate climate and latitude.
    d. Ability to divide the world into areas of low, middle, and high latitude.
    e. Ability to divide the world into hemispheres.
    f. Ability to divide the world into time zones.
    g. Ability to associate latitude and longitude with human activities.
    h. Ability to divide the world into degrees.

---

[1] Harold W. Littlefield, "The Construction and Evaluation of a Diagnostic Test on Map Skills for Grades Six, Seven, and Eight," unpublished Ed.M. Thesis, Boston University, School of Education, 1947.

4. Recognition and use of legends and symbols.
    a. Ability to get information from maps with symbols explained by a legend.

5. Recognition and use of specialized maps.
    a. Ability to get information from pattern maps giving facts about man and nature.

6. Recognition and use of graphs.
    a. Ability to get information from simple graphs of different types.

The test consisted of a series of maps. The answers to the questions appeared on the maps if the pupil had command of the use of the various skills. The following are some sample questions taken from the test:

1. What is the direction from A to F?

2. What is the distance in miles from C to B?

3. What is the approximate distance from F to the North Pole?

4. How many miles from city 7 to city 8?

5. What is the latitude of C?

6. What point is at 70 degrees N 11 degrees E?

7. When it is five o'clock at C, what time will it be at E?

8. What is the height of the highest hill?

9. How many inches of rainfall does state F get in a year?

10. What country grew the most wheat?

In an effort to find if elementary school children are developing the necessary skills for understanding maps,

George F. Howe[1] gave a test to pupils in grades five and six. The test covered the following areas:

1. Ability to know direction.
2. Ability to read and apply latitude and longitude
3. Ability to use the scale and approximate distances.
4. Ability to use the legend and apply it to the map.
5. Ability to read inscriptions on the map.

Included below are some sample test items taken from Howe's test:

1. What do the rows of little arrows tell?
2. How are the political boundaries shown?
3. What line of longitude passes through Cape Cod?
4. How much rainfall does Iowa have?
5. What is the capital of Saskatchewan?
6. In what direction is Seward, Alaska, from Nome, Alaska?
7. Name the city that is 76 degrees West and 43 degrees North?
8. What is the latitude and longitude of Washington, D. C.?
9. About how many miles is it from Cleveland to Chicago?
10. To what country does Vancouver Island belong?

According to Howe, however, simple though this may appear to the adult mind, it is evident that most of the questions

---

[1] George F. Howe, "A Study of the Ability of Elementary School Pupils to Read Maps," The Thirty-Second Yearbook, National Society for the Study of Education, Public School Publishing Company, Bloomington, Illinois, February, 1933, pp. 486-492.

involve a multiplicity of skills, failure in any one of which may cause error.

The Bureau of Research in New York City sponsored a test on map reading ability.[1] The aim was to measure the ability of children to use map symbols. This study concerned itself with eighth grade pupils in one section of the city in an attempt to measure the map-reading ability of children upon completion of the elementary school course. The test consisted of fifty-two questions: five on direction, six on interpretation of maps showing rainfall, twelve based on reasoning in relation to a map, thirteen on latitude and longitude, and sixteen on the use of the map key.

Listed below are some sample questions taken from the test:

1. Finding the latitude of a place by use of parallels on a map.
2. Finding the capital of a country.
3. Using the key showing the scale. Estimating the distance between two points.
4. Naming the colors used to represent a certain altitude.
5. Using a map showing the time belts of the United States make a comparison of the time in various places.
6. On a map where the North Pole is at the center, what direction is it from the Pole to a given point?

---

[1] The Bureau of Research, New York City, "Testing Map Reading Ability." Journal of Geography, Volume 30:38-42, January, 1931.

The test was of the multiple choice type. The Bureau of Research provided maps upon which the pupils answered. After an analysis of the test the Research Bureau issued the following statement:

> In general the pupils do well with questions about directions if North is toward the top of the map, East to the right, South to the bottom, and West to the left. Results on directions depended greatly on how the questions were asked. Take the following question as an example. Suppose that point A is south of point B. If the question is asked, "What point is directly south of B," more than 90 per cent of the pupils got it right. If the question was phrased differently and asked, "What direction from B to A," the results were much poorer. Questions covering the North Polar map brought only twenty-eight per cent correct answers. To most of the children North is always up. Questions covering the scale indicated a certain degree of familiarity with the scale but also an inability to use it accurately. The use of color for representing elevation is pretty well understood. However, ability to estimate rate of change in altitude is not too well developed. Questions on map symbols were fairly well handled particularly in locating capitals. The best results were obtained on the special maps, most of the children doing well on these questions.

The Bureau suggests that tests on map skills should be based on maps of hypothetical land bodies rather than existing maps so as to remove the possibility of gaining the information from memory.

Parallels and meridians present problems of difficulty to children. A. W. Abrams has analyzed a question of this

type.[1] Upon checking question fourteen of the June, 1927 Regents Examination in Geography it was found that in a majority of cases there was a total disregard of the use of meridians and parallels and a map was read as if north were in all cases directly toward the top.

Measurement of the ability of children to interpret graphs was done by Thomas.[2] The test was given to pupils in the fourth, fifth, sixth, and seventh grades, a total of three hundred fifty-five children. Three classes representing groups of slow, average, and superior children were tested in each grade. The same test was given in all grades in order to discover the adaptation of the type of graph to the grade as well as the ability of the children to read graphs. Thomas used the following types of graphs in her tests:

1. The circle graph
2. The two dimension diagram
3. The horizontal bar graph
4. The multiple-picture graph
5. The line graph

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[1] A. W. Abrams, "Observations on Answers to Question Fourteen of the June, 1927 Regents Examination," Bulletin to the Schools, The University of the State of New York.

[2] Katheryne C. Thomas, "The Ability of Children to Interpret Graphs," Thirty-Second Yearbook, National Society for the Study of Education, February, 1933, pp. 492-494.

The questions asked about each graph included questions involving:

1. Use of the key
2. Interpretation of the data
3. The reading of rank

Sample questions asked on the test were as follows:

1. What country produces the most wool?
2. How many acres are there in an average farm in Indiana?
3. Does Canada have more boats than the United States?

An analysis of the results brought forth several significant points concerning the adaptation of the type of graph to certain grade levels and the type of information that can be gained from graphs most easily. The questions involving the use of the graphs to gain information concerning rank were the easiest for all grades to answer. They were answered most easily for the two-dimension diagram, the pictorial graph, and the circle graph. Pupils of all grades tested found it difficult to read rank from the line graph. In order to interpret keys they were asked to read quantities from the graphs. This involved arithmetic skills not yet gained by the fourth and fifth graders. Besides this factor, which made results unsatisfactory, inaccuracy in arithmetical processes made it still more difficult to determine just how many pupils understood what should be done.

A study was conducted by Thorp[1] on the ability of pupils in grades four to eight in the use of geographic tools. Tests composed of a series of graded exercises were prepared. These were given without preliminary drills or suggestive helps to pupils in four types of schools: rural-consolidated, village, small city, and large city. There were five hundred fifty-six pupils tested between the ages of nine and fourteen. To demonstrate that most of the work could be handled by the group, one sixth grade group was used as an experimental division. Over a six week period prior to taking the tests, these particular pupils received intensive drill in the use of the tools. Then they were given the test along with the other children. The results were given in tables with percentages of correct, incorrect, and omitted answers. Thorp's tests covered the following areas:

1. To determine the knowledge of general globe factors.
2. To determine understanding of latitude as a means of globe location.
3. To determine understanding of longitude as a means of globe location.
4. To determine ability to recognize continental masses and the larger bodies of water.
5. To determine power to route a path in accurate scale measurement.
6. To determine understanding and use of legend.

---

[1] Mary Tucher Thorp, "Studies of the Ability of Pupils in Grades Four, Five, Six, Seven, and Eight to Use the Geographic Tools," Thirty-Second Yearbook, National Society for the Study of Education, February, 1933, pp. 494-507.

7. To determine ability to use a scale.
8. To determine understanding of rain-bearing winds.
9. To determine understanding of isothermal lines.
10. To determine power to read and interpret diagrams.
11. To determine ability to read and interpret a bar graph.
12. To test ability to construct a circle graph.

Thorp drew the following conclusion:

Incidental teaching of correct usage of geography tools has failed. The work is easily within the comprehension of the average sixth grader as proved by the excellent results of the experimental group.

One of the problems in constructing a test on map skills is the elimination of terms and misconceptions that grade children develop on the terms of the different zones: torrid, temperate, and frigid. Aitchison[1] gave a test to one thousand one hundred and ten pupils in the sixth, seventh, and eighth grade plus some college students. Results gained indicated that college students have the same misconceptions as grade children. Aitchison's conclusion was that terms such as torrid, temperate, and frigid should be omitted because they hinder clear geographic thinking. It would be better to introduce low latitude, middle latitude, and high latitude.

1/ Alison E. Aitchison, "Torrid, Temperate, and Frigid Zones, Sources of Error in Children's Thinking." Thirty-Second Yearbook of the National Society for the Study of Education, February, 1933, pp. 483-485.

CHAPTER III

TEST CONSTRUCTION

The problem of constructing a test that would measure map skills was a major one. An underlying philosophy upon which to build the foundation had to be adopted. Bowman[1] indicated best the importance of maps and the need for understanding them when he said:

> Maps embody the most distinctive measurement of geography. A map is a locational guide for both earth features and human distributional elements. It is also a means of putting things together. Exactness of map distinction is not merely a response to aesthetic standards but goes to the very root of many a question. The mariner wishes to know the exact location of his ship in relation to a possible landfall. In statistical plotting a place must be there and not there-abouts.

The next step was to weigh all available sources in order to obtain the criteria formulated by authorities as the necessary objectives of children learning map skills in the grades.

Thorp[2] outlines in the following chart the suggested grade placement of geography tools.

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[1] Isiah Bowman, "Geography in Relation to the Social Sciences," Report of the Commission on the Social Sciences, Part V, American Historical Association, Boston, Charles Scribner's 1934, p. 42

[2] Mary Tucher Thorp, "Studies of Ability of Pupils in Grades Four, Five, Six, Seven, and Eight to Use the Geographic Tools," Thirty-Second Yearbook, National Society for the Study of Education, February, 1933, p. 506

SUGGESTED GRADE PLACEMENT OF GEOGRAPHY TOOLS
(I, Incidental; T, Teach the usage; D, Drill on the usage)

Tool	Grade IV B	 IV A	 V B	 V A	 VI B	 VI A
I. Globe Study						
General Location	I	T	T	D	D	
Latitude		I	T	T	T	D
Longitude		I	T	T	T	D
Continents--Oceans	I	T	T	T	D	D
II. Map Reading						
Route Sketching		I	I	T	T	D
Legend Reading	I	I	T	T	T	D
Measurements to Scale			I	I	T	T
III. Picture Study						
Observation	T	T	D	D	D	
Interpretation	I	I	T	T	T	D
IV. Climatic Elements						
Location of Wind Belts		I	I	T	T	T
Areas of Rain		I	I	T	T	T
Isotherm-Making			I	I	T	T
Isotherm-Reading and Interpretation			I	I	I	T
V. Diagram Study and Use						
Rainfall against Mountain		I	I	T	T	D
Delta Lands	I	I	T	T	D	D
Oasis	I	T	T	D	D	D
Original, Free Sketching	I	I	I	T	T	T
VI. Interpretation of Life						
Responses from Diagrams and Maps				I	T	T
VII. Index						
Pronunciation	T	T	T	T	D	D
General Use	I	I	T	T	D	D
VIII. Appendix						
Table-Making		I	I	T	T	D
Table-Reading		I	I	T	T	T
Statistical Computation						
IX. Graphs						
Picture Graph	I	T	T	D	D	D
Broken-line--Bar:Reading		I	I	T	T	D
Graph Interpretation		I	I	I	T	T
Making Simple Graphs		I	T	T	D	D
Making Circle Graph					I	I
Numerical Study in Graphs						I

SUGGESTED GRADE PLACEMENT OF GEOGRAPHY TOOLS
(I, Incidental; T, Teach the usage; D, Drill on the usage)

Tool	Grade			
	VII B	VII A	VIII B	VIII A
I. Globe Study				
General Location				
Latitude	D	D		
Longitude	D	D		
Continents--Oceans				
II. Map Reading				
Route Sketching				
Legend Reading	D			
Measurements to Scale	D			
III. Picture Study				
Observation				
Interpretation				
IV. Climatic Elements				
Location of Wind Belts	T	D	D	
Areas of Rain	D	D		
Isotherm-Making	T	T	D	D
Isotherm-Reading and Interpretation	T	T	D	D
V. Diagram Study and Use				
Rainfall against Mountain				
Delta Lands				
Oasis				
Original, Free Sketching	D	D	D	D
VI. Interpretation of Life				
Responses from Diagrams and Maps	T	T	D	D
VII. Index				
Pronunciation	D			
General Use	D			
VIII. Appendix				
Table-Making	D	D	D	
Table-Reading	D	D	D	
Statistical Computation				
IX. Graphs				
Picture Graph				
Broken-line--Bar:Reading	D	D	D	
Graph Interpretation	T	D	D	
Making Simple Graphs	D			
Making Circle Graph	T	T	D	D
Numerical Study in Graphs	I	T	T	T

Baker[1] lists the following achievements for children entering grade seven:

1. Ability to use directions using maps with straight and curved parallels and meridians.
2. Ability to use the scale with the same type of maps.
3. Ability to use the scale on a map with a larger scale and repeating the same question.
4. Ability to use the scale of a map of the world to find if the children know that the scale cannot be used all over the map.
5. Ability to use physical features such as naming peninsulas, islands, harbors.
6. Ability to use rivers in relation to direction of flow.
7. Ability to use map legend and its significance.
8. Ability to use various types of maps and their names.
9. Ability to use color to show physical features.
10. Ability to use map symbols.

Lange[2] believes the following requirements should have been mastered by the sixth grade:

1. Knowledge of zones and names of the lines associated with them.
2. Knowledge of degrees and number of miles to a degree of latitude.
3. The relationship between latitude and climate.
4. Knowledge of latitude and longitude.

1/ Emily V. Baker, "Diagnosing Children's Ability to Use Maps," Journal of Geography, Volume 37: 227-231, September, 1938.

2/ Stella R. Lange, "A Geography Test," Journal of Geography, Volume 34: 40-41, January, 1935.

Uttley[1] sets up these pre-requisites in geography for entrance into the junior high school:

1. Understanding of latitude and longitude.
2. Knowledge of the time belts.
3. Ability to read graphs in terms of multiple units.
4. Using latitude and longitude to locate places on maps.

Shryock's[2] standards cover the same basic information:

1. Use of the scale.
2. Knowledge of direction.
3. Use of degrees.
4. Knowledge of latitude, longitude, and the fundamentals of projection.
5. Telling time by use of longitude.
6. Use of graphs in relation to multiple units.

Major types of abilities to be gained in the junior high school geography map program are outlined as follows by Graham:[3]

1. Ability to recognize and get descriptive information from the following types of maps, which have not been used in earlier work:
    a. Temperature and pressure maps.
    b. Possibly the topographic map of the home locality.
    c. Large scale maps of small areas.

---

[1] Marguerite Uttley, "A Provisional Formulation of Attainments in Geography for the Elementary School." Thirty-Second Yearbook for the National Society for the Study of Education, February, 1933, pp. 247-264.

[2] Clara M. Shryock, "Gradations in Map Learning," Journal of Geography, Volume 38: 5, May, 1939.

[3] Marie C. Graham, "Geography in the Junior High School," Thirty-Second Yearbook, National Society for the Study of Education, February, 1933, pp. 265-286.

   - d. Maps of harbors.
   - e. World trade and trade-route maps.
   - f. Possibly weather maps.

2. Ability to read specific information from the following types of graphs:
   - a. The circle graph
   - b. The combination graph where two or more things are shown; e. g., temperature by line and rainfall by bars.

3. Ability to read facts of geographic significance from a greater variety of statistical tables and more complicated types of graphs.

4. To see the geographic significance of certain lines of latitude, such as the 40th parallel, and certain lines of longitude, such as the 100th meridian.

5. To see the exact location of any region in terms of latitude and longitude and part of the earth's surface it occupies.

6. To think in terms of varying lengths of degrees of longitude as contrasted with the very slight variation in length of degrees of latitude.

7. To read the relationship between the several kinds of information shown on a combination graph.

8. To make inferences and raise geographical problems from a variety of statistical tables.

Considering geography in the senior high school Foster 1/ had this to say in relation to map skills:

1. There should be facility in gleaning from statistical tables the salient facts bearing upon a problem regarding commercial patterns.

2. There should be a recognition of the fact that many conditions indicated by statistical tables change from year to year.

3. There should be facility in using a map index giving location in terms of latitude and longitude.

1/ Alice Foster, "Geography in the Senior High School," _Thirty-Second Yearbook, National Society for the Study of Education_, February, 1933, pp. 287-306.

4. There should be ability to translate descriptive or statistical statements regarding patterns shown on map.

5. There should be ability to translate descriptive or statistical statements regarding commercial patterns into map symbols.

6. There should be ability to read simple facts of slope, altitude, and the location of cultural features from topographic maps.

In the field of measurement, the Public School Achievement Test has one section devoted to map work.[1/] The test is based on eleven map questions taken from western Europe. The questions cover:

1. Longitude
2. Place location
3. Use of the scale
4. Time zones
5. The earth's surface.

Another test, "The Wiedefield-Walther Geography Test, A,"[2/] measures map skills for grades four through eight. The test consists of six parts, the third part is on map and graph reading. Test three measures the following:

1. Recognition of symbols
2. Recognition of direction
3. Estimation of area

[1/] Public School Achievement Test, Battery B, Form III, Grades Six to Eight, Public School Publishing Company, Bloomington, Illinois, 1930.

[2/] Wiedefield-Walther Geography Test, Form A, Grades Four through Eight, World Book Company, New York, 1939.

4. Location of latitude and longitude
5. Estimation of distance
6. Estimation of land and altitude
7. Fact finding from isotherms
8. Orientation of maps
9. Reading relations through comparative use of maps.

The "Iowa Every-Pupil Test of Basic Skills" is comprised of four parts of which Test B is concerned with the fundamentals of map reading.[1/] The test manual tests the grade skills in map reading as follows:

1. Ability to see the represented area in its natural plane and to read directions correctly.
2. Ability to recognize and interpret map symbols.
3. Ability to identify and to visualize symbols with the use of a key.
4. Ability to get facts and information from parallels and meridians.
5. Ability to read and interpret facts from pattern maps.

In relation to graphs, the manual states that the basic skills necessary are as follows:

1. Ability to comprehend from the title the topic on which the graph gives information.
2. Ability to read amounts from a graph.
3. Ability to compare two or more values read from a graph.
4. Ability to determine trends as shown on a line graph.

[1/] "Manual for Interpretation of Iowa Every-Pupil Test of Basic Skills, Form L," Houghton, Mifflin Company, Boston, 1940.

5. Ability to realize that percentages do not give absolute amounts.
6. Ability to compare values given in different columns in a table, in order to solve a problem.
7. Ability to grasp the outstanding fact portrayed by a graph.
8. Ability to determine rank from an unordered list of numbers.

A study of textbooks used for the study of geography at the elementary and junior high school level brought forth no new material. The basic material in the test books include:

1. Latitude and longitude
2. Direction
3. Time zones
4. Legend
5. Scale
6. Distance
7. Simple graphs of all types.
8. Pattern maps.

The newer tests have added air maps with much emphasis placed on the polar type of map.

The problem of selecting the material upon which to base this test proved to be a major one. The following factors were considered and evaluated.

1. An analysis was made of the research in order to take into consideration what had previously been done.

2. The basic skills taught in the grades were evaluated in an effort to determine which are considered of primary importance.

3. Textbooks used in the town of Swansea as well as texts used in other sections were studied to determine the scope of material in them.

4. Teachers in grades four, five, six, seven, and eight were consulted in relation to what they considered the basic fundamentals of map reading skills.

5. A study was made as to what authorities in the field of geography stressed as the foundation of map reading.

After an analysis of these factors the following were selected as a basis upon which to build an instrument to determine whether the pupils of the tenth, eleventh, and twelfth grades are able to read maps, graphs, and charts better and more skillfully than the pupils of the seventh, eighth, and ninth grades. The areas selected are basic for map reading and are comprehensive enough to measure the capacities of each individual. The selection made is as follows:

1. Recognition of direction
   a. Ability to know directions as expressed in terms of the cardinal and mid-cardinal points of the compass.
   b. Ability to know directions at the poles by using the parallels of latitude and meridians of longitude.

2. Recognition of scale
   a. Ability to measure distance on maps of different scale and different projection.

3. Recognition of latitude and longitude
   a. Ability to locate and designate points
   b. Ability to divide the world into low, middle, and high latitudes and into hemispheres.

   c. Ability to reckon time by longitude.
   d. Ability to recognize the change in days that takes place at the International Date Line.

4. Recognition of climatic elements
   a. Ability to associate the wind belts of the world with climate.

5. Recognition of legend and symbols
   a. Ability to get information from a map key.

6. Recognition of graphs
   a. Ability to get information from simple and multiple graphs.

The choice of the type of test to be administered limited itself to three types:

1. A functional test.

2. A factual test.

3. A combination functional and factual test.

The purpose of this test is measurement, therefore it was deemed best to use the functional type test because it would serve best the author's desire of measuring skills and eliminate memorization.

Based on Littlefield's 1/ experience of having many questions unanswered, a test of the multiple choice type was selected in order to get the children to express themselves.

The maps selected for the test were the Mercator or flat projection because of its wide use in schools, the stereographic projection, and the North and South Polar maps.

1/ Littlefield, H. W., "The Construction and Evaluation of a Diagnostic Test in Map Skills for Grades Six, Seven, and Eight." Unpublished Ed. M. Thesis, Boston University, School of Education, 1947.

Of the twelve maps and grids used in the test, six of them depict familiar land masses and six of them do not. This was done to find if the children had the ability to make practical use of the map reading skills.

In relation to using real and imaginary land forms, the author made use of both. This was done to eradicate the use of memory in answering questions where ever possible.

The complete test was made up of sixteen tests, each a complete unit. The units can be given separately or the test can be administered as a whole unit. To facilitate pupil ease of reading and to eliminate confusion, the maps, diagrams, and questions were included on the same page. It was the writer's purpose to make administration by the teacher as easy as possible. This was done by fastening the tests together and giving the test in booklet form as a complete unit. To aid in acquiring interest, introductory remarks were included on the cover. The children taking the test were encouraged to proceed at their own pace. Time was allowed for all of them to finish.

The maps and questions divide themselves into groups.

Group I--Twenty questions on the recognition of direction. In each group the questions became more difficult as one proceeds.

Group II--Ten questions on the recognition of scale.

Group III--Twenty questions on the use of latitude and longitude in relation to position, time zones and the International Date Line.

Group IV--Five questions on the ability to associate the wind belts of the world with climate.

Group V--Ten questions on the use of legend and map symbols. The map used defines no actual place.

Group VI--Twenty questions on the recognition and use of graphs. These questions were based on four types of graphs. The graphs were the bar graph, circle graph, combination line-bar graph, and the line graph. These graphs are commonly used and provide a good test of graph reading ability.

The complete test is composed of ninety questions. It was borne in mind that there should be a range of item difficulty sufficient to test both the poorest and the keenest students. There was an attempt to construct the test so that there would be a few questions which even the twelfth graders would have difficulty in completing. There was to be only a single correct answer for each question.

The test was then given to several teachers, principals and the superintendent of schools for criticism and their

evaluations resulted in some changes. The test was then given its preliminary try-out, being administered to the seventh and eighth grades in the town of Dighton. A few minor changes in the wording of the questions were then made. Some of the questions were beyond the ability of some of the pupils to answer. However, these questions were left intact until a more comprehensive testing could be accomplished. The fact that some of the pupils scored high marks in the test without direct preparation for it, showed that the skills were comparable to the seventh grade.

The final step was to mimeograph four hundred tests and administer them to the different grades to see how well the test measured and which items were significant. Extreme care had to be utilized in order to see that every line on the maps was clear-cut. The test was then ready for final administration.

A DIAGNOSTIC TEST ON MAP SKILLS FOR GRADES TEN, ELEVEN, AND TWELVE TO BE COMPARED WITH THE RESULTS OF AN IDENTICAL TEST FOR GRADES SEVEN, EIGHT, AND NINE.

The Basic Skills

1. Recognition of direction
   a. Ability to know directions as expressed in terms of the cardinal and mid-cardinal points of the compass.
   b. Ability to know directions at the poles by using the parallels of latitude and meridians of longitude.

2. Recognition of scale
   a. Ability to measure distance on maps of different scale and different projection.

3. Recognition of latitude and longitude
   a. Ability to locate and designate points.
   b. Ability to divide the world into low, middle, and high latitudes and into hemispheres.
   c. Ability to reckon time by longitude.
   d. Ability to recognize the change in days that takes place at the International Date Line.

4. Recognition of climatic elements
   a. Ability to associate the wind belts of the world with climate.

5. Recognition of legend and symbols
   a. Ability to get information from a map key.

6. Recognition of graphs
   a. Ability to get information from simple and multiple graphs.

MAPS CAN BE FUN!

As you sit and gaze out of the window what are you dreaming about? Perhaps you think of the day when you can fly your own airplane or be a pilot or navigator in the United States Air Force. Do you have a desire to drive Dad's car and take a trip across the country? Are you dreaming of the day when you are a successful businessman or a weather forecaster? Maybe you would like to be an airline hostess. Being captain of a ship or looking for buried treasures may fascinate you. Building your own house or reading blue prints as a carpenter or machinist is interesting. Would you like to be a teacher or plant a beautiful flower garden? Does skiing in the White Mountains or coaching the football or basketball team intrigue you? Whatever it is, you want to make this dream come true.

Inside this booklet are the tools to your dreams. Why not open it and see if you have mastered the skills necessary to qualify you for your future career?

Name ________________________________
Last First

Age ________________________
Years Months

Town ________________________ School ____________________

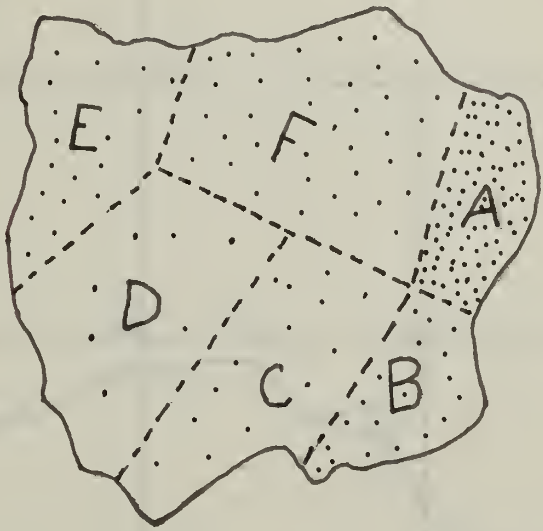
Date ________________________ Grade ____________________
Year Month Day

Complete Test

	Possible Score	Pupil's Score	
Test I	5	I	________
Test II	5	II	________
Test III	5	III	________
Test IV	5	IV	________
Test V	5	V	________
Test VI	5	VI	________
Test VII	10	VII	________
Test VIII	5	VIII	________
Test IX	5	IX	________
Test X	5	X	________
Test XI	5	XI	________
Test XII	10	XII	________
Test XIII	5	XIII	________
Test XIV	5	XIV	________
Test XV	5	XV	________
Test XVI	5	XVI	________
Total	90	Total	________

Sample Map

Pattern Map Showing the Number of people in states A, B, C, D, E, F. Each dot represents 10,000 people.



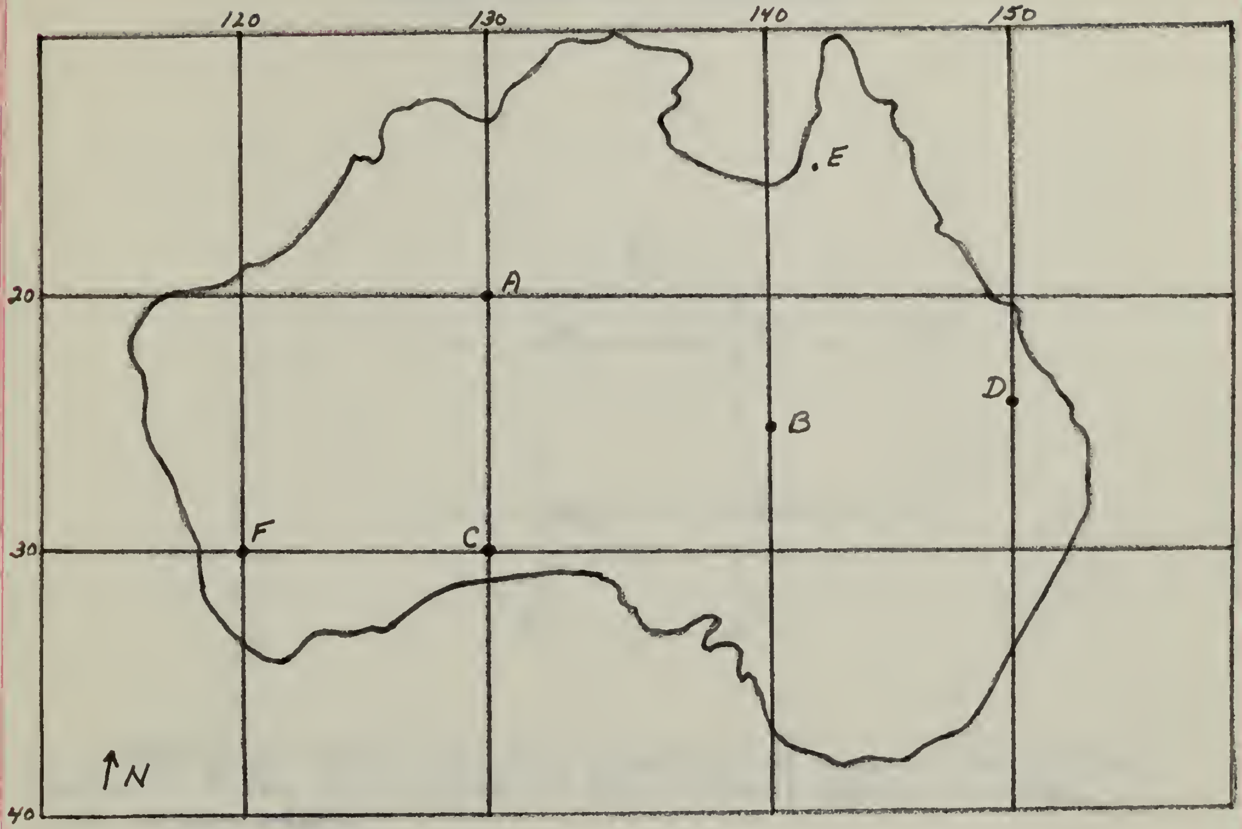
Example: ALL QUESTIONS ARE OF THIS TYPE
This is easy. Study the map and then answer question one by selecting the correct answer and placing the letter of this correct answer on the line at the right.

1. What state has the most people? 1._____
a. State E b. State C
c. State A d. State F

2. What state has the smallest population? 2._____
a. State A b. State F
c. State C d. State D

TEST I

Recognition of Direction



Do you know your directions? By using the map above select the correct answer and place the letter of the correct answer on the line at the right.

1. What direction is A from C? 1._____
   a. South b. East c. West d. North e. Northeast

2. What direction is C from F? 2._____
   a. East b. West c. North d. South e. Southwest

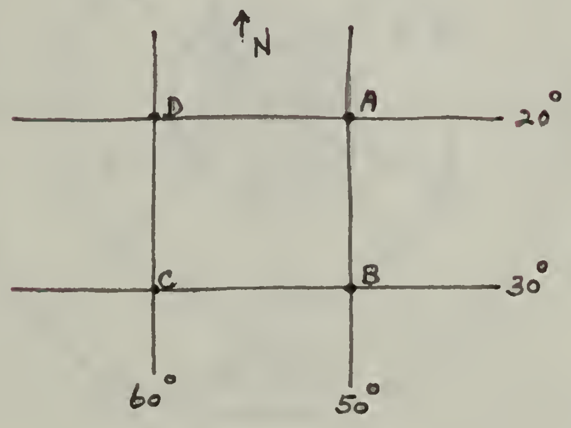
3. What direction is B from D? 3._____
   a. North b. Southeast c. West d. East e. South

4. What direction is E from A? 4._____
   a. Southwest b. North c. Northeast d. East
   e. Northwest

5. What direction is F from A? 5._____
   a. Southwest b. Southeast c. Northeast
   d. Northwest e. North northeast

TEST II

Recognition of Direction



Where are you? Use the diagram and select the correct answer. Place the letter of the correct answer on the line at the right.

1. What direction is B from A? 1._____
   a. North b. South c. East d. West

2. What direction is C from B? 2._____
   a. South b. East c. North d. West

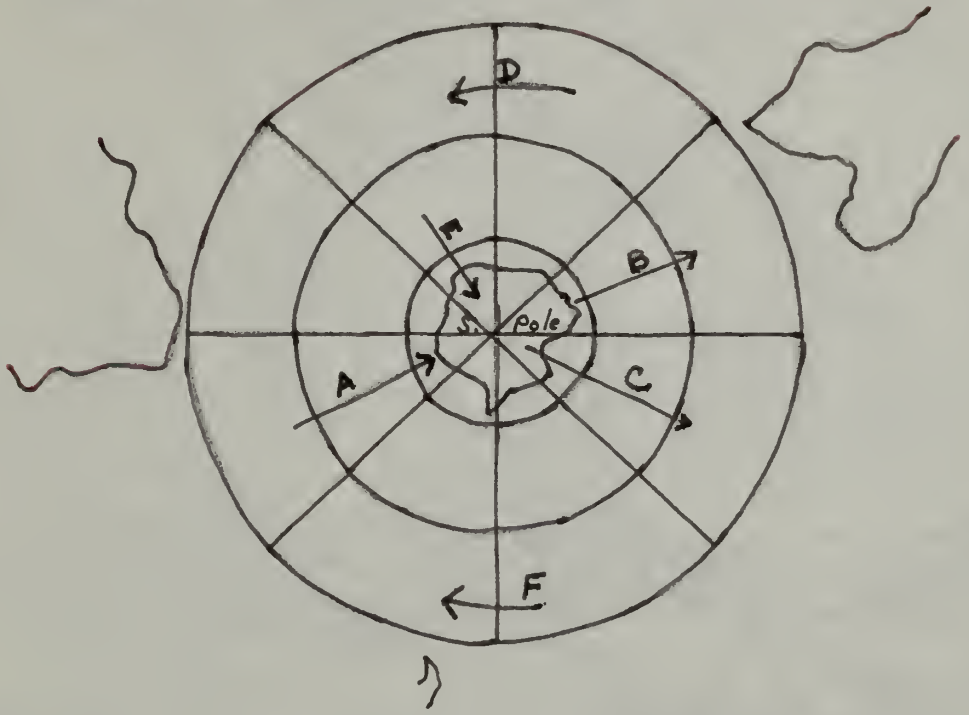
3. What direction is the equator from dot A? 3._____
   a. West b. North c. South d. East

4. What direction is the prime meridian from dot B? 4._____
   a. East b. South c. North d. West

5. What direction is B from D? 5._____
   a. North b. Southeast c. Northeast d. West

TEST III

Recognition of Direction at the South Pole



Admiral Byrd knew his directions at the South Pole. Do you? Select the correct answer and place the letter of it on the line at the right.

1. What direction is arrow A pointing? 1._____
   a. South b. North c. East d. West e. Northeast

2. What direction is arrow B pointing? 2._____
   a. East b. North c. South d. West e. Southwest

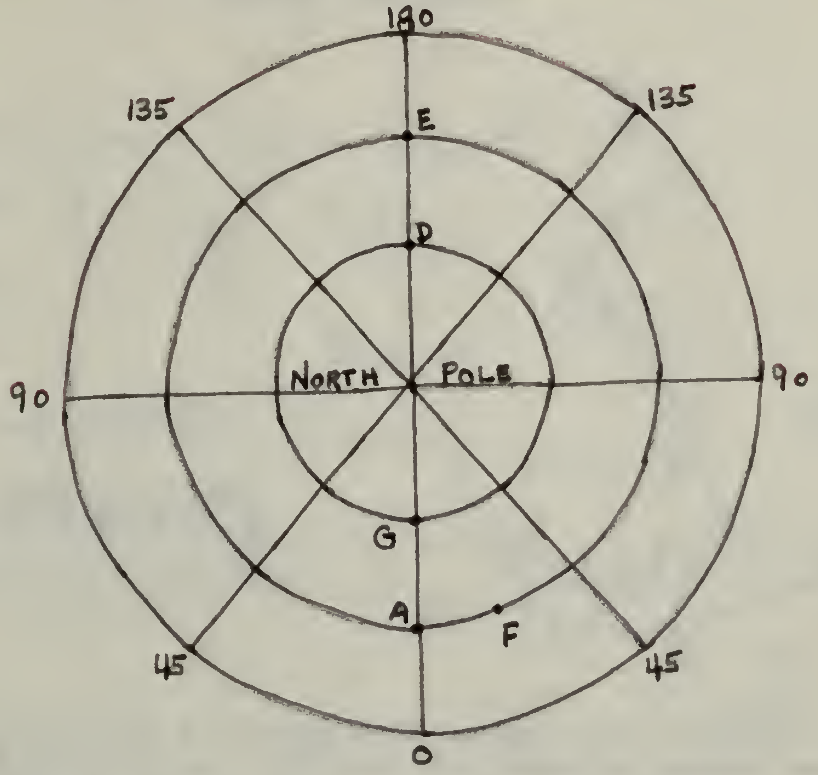
3. What direction is arrow C pointing? 3._____
   a. West b. South c. North d. East e. Southeast

4. What direction is arrow D pointing? 4._____
   a. East b. North c. West d. South
   e. Toward the pole

5. What direction is arrow E pointing? 5._____
   a. North b. East c. South d. West e. Southeast

TEST IV

Recognition of Direction at the North Pole



Can you qualify as a bomber pilot near the North Pole? If so, select the correct answer and place the letter of it on the line at the right.

1. What direction is D from E? 1._____
   a. South b. East c. North d. West

2. What direction is E from F? 2._____
   a. South b. East c. West d. North
   e. East or west

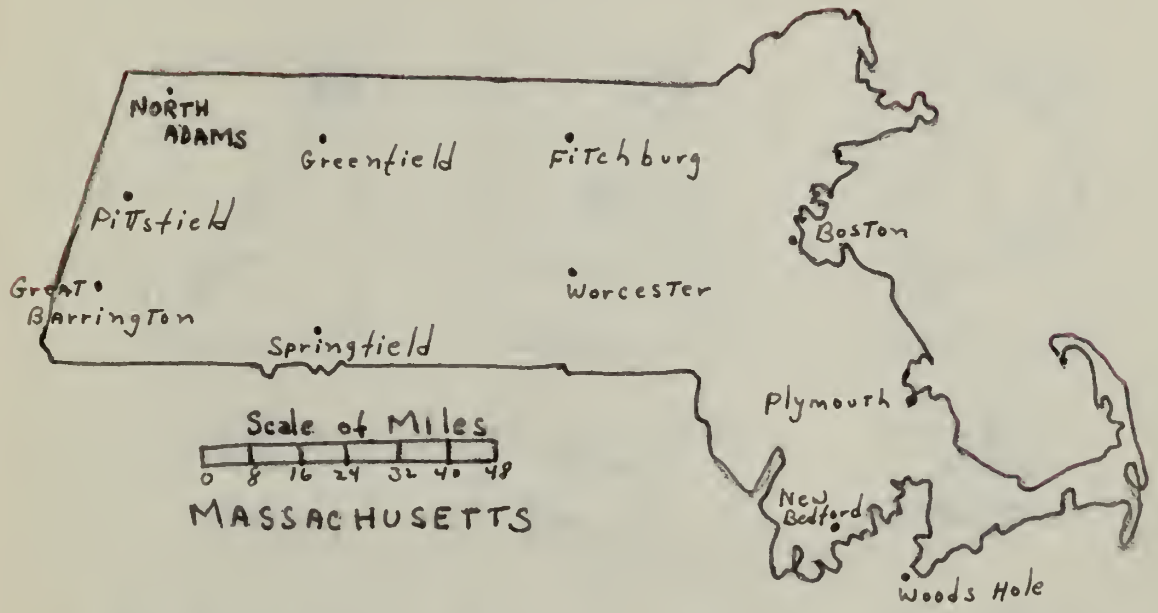
3. What direction is G from E? 3._____
   a. North b. South c. East d. West
   e. East or west

4. What direction is A from G? 4._____
   a. South b. North c. East d. West e. Southwest

5. What direction is A from F? 5._____
   a. East b. North c. West d. South e. Southeast

TEST V

Use of the Scale



Are you helping Dad plan a trip for this summer? Then you can do this problem. Select the correct answer and place the letter of it on the line at the right.

1. How far is it from Boston to Worcester? 1._____
a. 25 miles b. 38 miles c. 40 miles
d. 35 miles e. 100 miles

2. How far is it from Worcester to Springfield? 2._____
a. 48 miles b. 36 miles c. 42 miles
d. 39 miles e. 75 miles

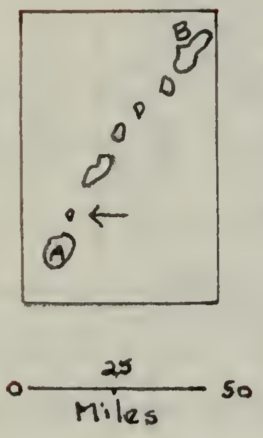
3. How far is it from Springfield to Pittsfield? 3._____
a. 10 miles b. 25 miles c. 60 miles
d. 40 miles e. 45 miles

4. How far is it from Boston to New Bedford? 4._____
a. 48 miles b. 43 miles c. 24 miles
d. 60 miles e. 45 miles

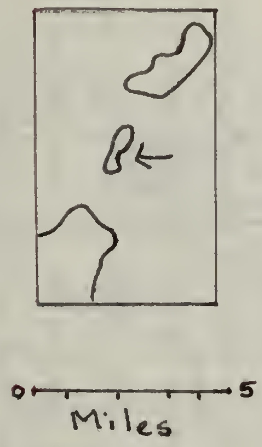
5. How far is it from Pittsfield to North Adams? 5._____
a. 21 miles b. 5 miles c. 18 miles
d. 14 miles e. 50 miles

TEST VI

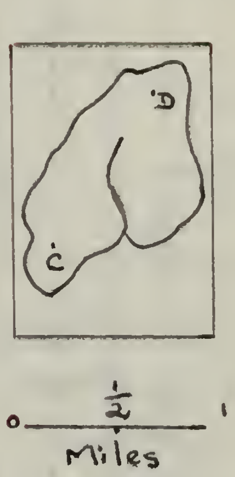
Use of Scales



Map I



Map II



Map III

Maps use different scales. Don't let these stump you. Select the correct answer and place the letter of it on the line at the right.

1. Of these three maps which has the largest scale? 1._____
   a. Map I b. Map II c. Map III d. All the same

2. How many miles is it across Map I? 2._____
   a. 1 mile b. $\frac{1}{2}$ mile c. 25 miles d. 50 miles

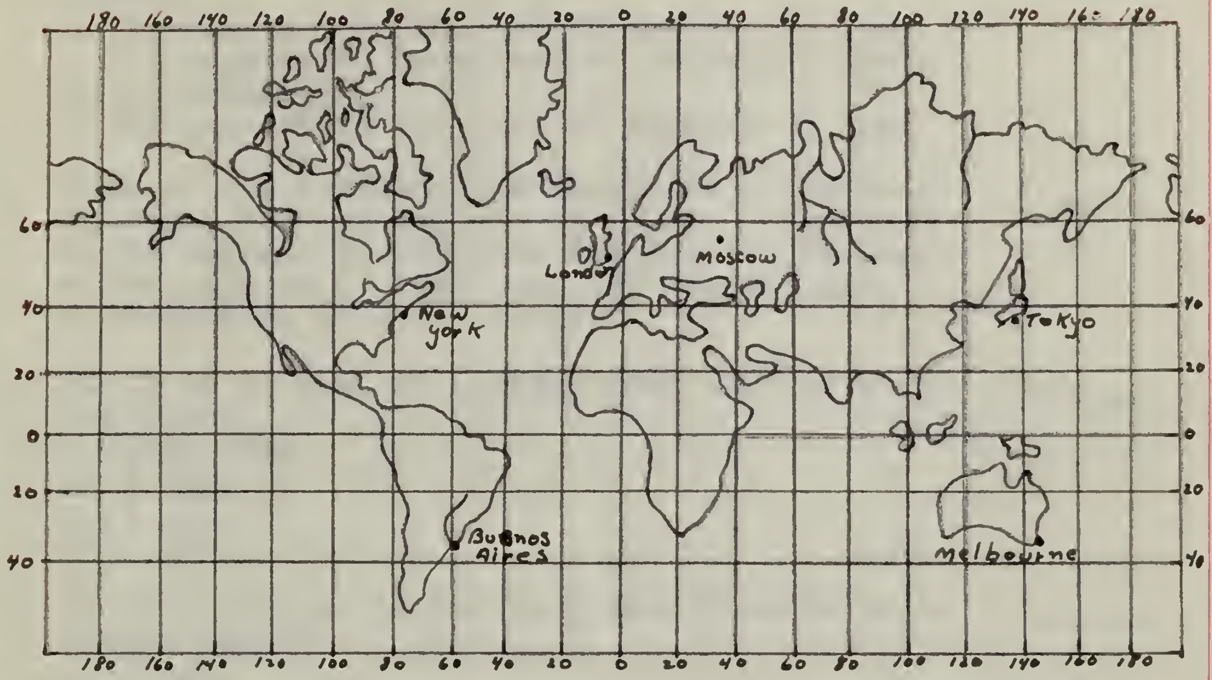
3. How many miles is it from the top to the bottom of Map II 3._____
   a. 10 miles b. $7\frac{1}{2}$ miles c. 5 miles d. $12\frac{1}{2}$ miles

4. What is the distance from point A to point B on Map I? 4._____
   a. $62\frac{1}{2}$ miles b. 50 miles c. 1 mile d. $27\frac{1}{2}$ miles

5. What is the distance from point C to point D on Map III 5._____
   a. $\frac{1}{2}$ mile b. 3/4 mile c. 1 mile d. $1\frac{1}{4}$ miles

TEST VII

Mercator Map Showing Latitude and Longitude



Pilot to Navigator--Are we nearing destination? What time is it? What day is it? You can be the navigator by selecting the correct answer and place the letter of it on the line at the right. lat. equals latitude
long. equals longitude

1. What is the latitude and longitude of New York? 1._____
   a. 40 degrees S. Lat. and 75 degrees E. Long.
   b. 40 degrees N. Lat. and 75 degrees W. Long.
   c. Near Providence
   d. 40 degrees N. Long. and 75 degrees W. Lat.

2. What is the latitude and longitude of London? 2._____
   a. 50 degrees N. Lat. and 0 degrees Long.
   b. 50 degrees S. Lat. and 40 degrees E. Long.
   c. Near Europe
   d. 50 degrees Long. and 0 degrees Lat.

3. What is the latitude and longitude of Tokyo? 3._____
   a. Near China
   b. 38 degrees S. Lat. and 138 degrees E. Long.
   c. 38 degrees N. Lat. and 138 degrees E. Long.
   d. 38 degrees N. Lat. and 138 degrees W. Long.

TEST VII (CONT.)

4. What is the latitude and longitude of Buenos Aires? 4._____
   a. 37 degrees S. Lat. and 60 degrees W. Long.
   b. 37 degrees S. Long. and 60 degrees W. Lat.
   c. In Mexico
   d. 37 degrees N. Lat. and 60 degrees W. Long.

5. What is the latitude and longitude of Melbourne? 5._____
   a. right side of map
   b. 38 degrees S. Lat. and 143 degrees E. Long.
   c. 38 degrees E. Long. and 143 degrees Lat.
   d. Somewhere in the Pacific

6. If it is 11 a.m. in London, what time is it in New York? 6._____
   a. Same time
   b. 6 a.m.
   c. 6 p.m.
   d. 3 a.m.

7. If it is 4 p.m. in New York what time is it in Buenos Aires? 7._____
   a. 3 p.m.
   b. Same time
   c. 5 p.m.
   d. 3 a.m.

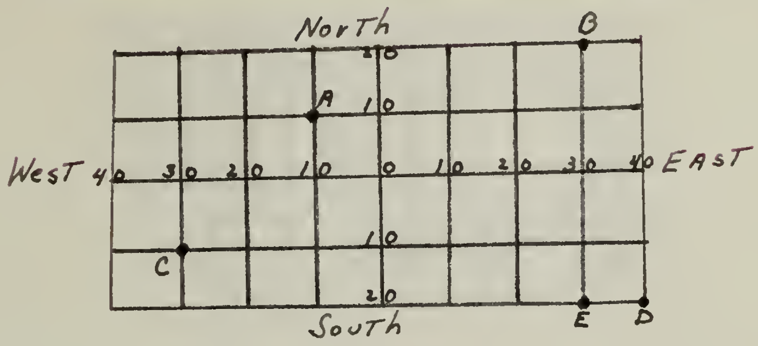
8. If it is 8 p.m. in London, what time is it in Moscow? 8._____
   a. 10 p.m.
   b. 6 p.m.
   c. Same time
   d. 1600 Hours

9. You leave San Francisco on Friday and fly west, what day is it when you cross the International Date Line? 9._____
   a. Friday
   b. Saturday
   c. Thursday

10. You leave Moscow, Russia on Tuesday and fly east, what day is it when you cross the International Date Line? 10._____
    a. Tuesday
    b. Monday
    c. Wednesday

TEST VIII

Use of Latitude and Longitude



Save our ship! S O S! Can you help them? Sure you can. Select the correct answer and the letter of the correct answer place on the line at the right.

1. What is the latitude and longitude of Point A? 1.______
    a. 10 degrees S. Lat. and 10 degrees E. Long.
    b. 10 degrees N. Lat. and 10 degrees W. Long.
    c. South of the Equator
    d. 10 degrees W. Lat and 10 degrees N. Long.

2. What is the latitude and longitude of Point B? 2.______
    a. 20 degrees N. Lat. and 30 degrees E. Long.
    b. 20 degrees S. Lat. and 30 degrees E. Lat.
    c. West of the prime meridian
    d. 30 degrees N. Long. and 20 degrees E. Lat.

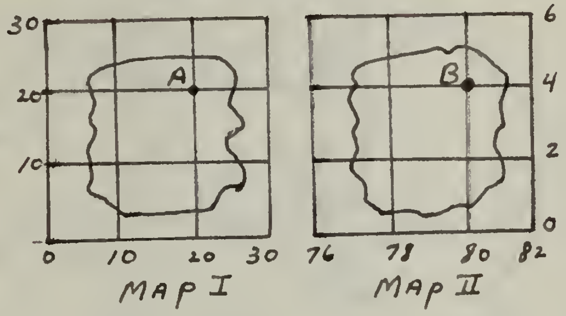
3. What is the latitude and longitude of Point C? 3.______
    a. 20 degrees N. Lat. and 10 degrees E. Long.
    b. 10 degrees S. Lat. and 30 degrees W. Long.
    c. 70 degrees N. of the South Pole
    d. 10 degrees S. Lat. and 30 degrees E. Long.

4. What is the latitude and longitude of Point D? 4.______
    a. 20 degrees S. Lat. and 40 degrees E. Long.
    b. 20 degrees N. Lat. and 40 degrees E. Long.
    c. Near New England
    d. 40 degrees E.

5. What is the latitude and longitude of Point E? 5.______
    a. 20 degrees N. Lat. and 30 degrees E. Long.
    b. 20 degrees S. Lat. and 30 degrees E. Long.
    c. Near Chile
    d. Near Fall River

TEST IX

Degrees of Latitude and Longitude



Would you like to explore two islands near the equator? If you can select the correct answer to each question and place the letter of it on the line at the right, then you will know which island is the closest to the equator.

1. Which of these two maps show the larger area? 1._____
a. Map I b. Map II c. Both the same

2. What is the interval between grid lines on Map I?2._____
a. 20 b. 30 c. 10 d. 60

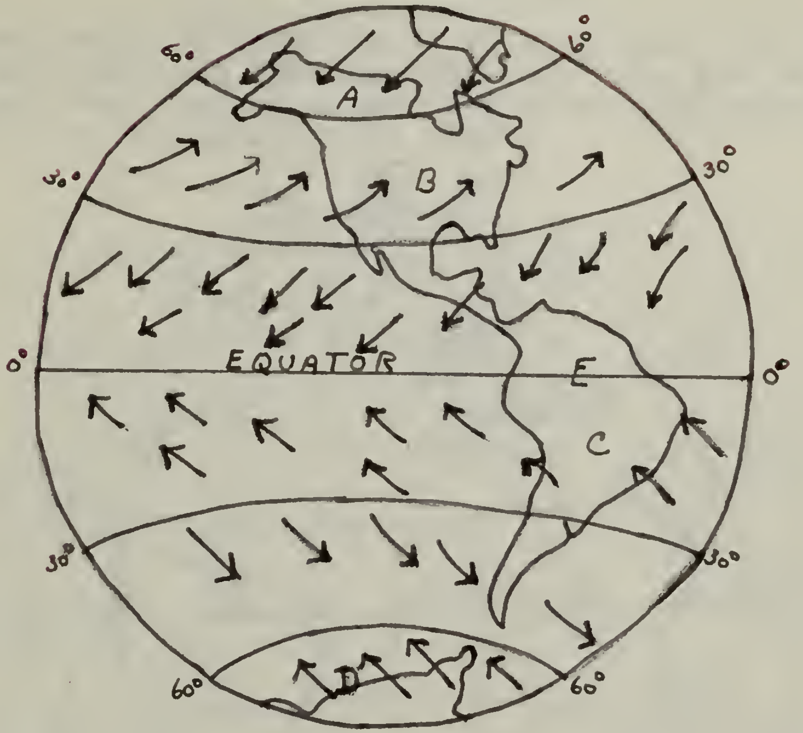
3. What is the interval between grid lines on Map II? 3._____
a. 4 b. 80 c. 2 d. 82

4. Which of these two islands is the biggest? 4._____
a. The island on Map I
b. The island on Map II
c. Almost the same

5. Is point A or point B nearest the equator? 5._____
a. A b. B c. Equally distant d. A is 10 miles and B is 40 miles from the equator.

TEST X

Wind Belts



This looks difficult but do not become upset. America was discovered because Columbus learned to understand this map. Why not try it? Select the correct answer and place the letter of it on the line at the right.

1. What wind belt is letter C in? 1._____
a. Polar Easterlies b. Northeast Trades
c. Southeast Trades d. Westerlies

2. What wind belt is A in? 2._____
a. Polar Easterlies b. Westerlies c. Calms
d. Trades

3. What wind belt is letter E in? 3._____
a. Westerlies b. Northeast Trades c. Calms
d. Polar Easterlies

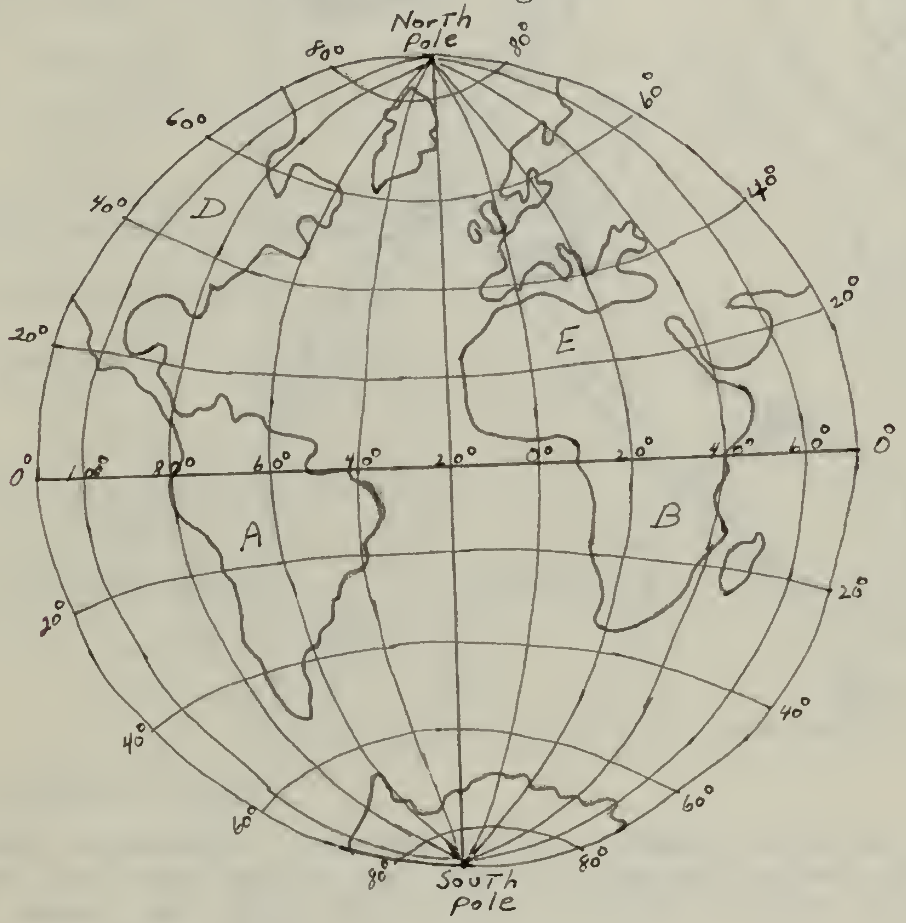
4. What wind belt is letter B in? 4._____
a. Southeast Trades b. Westerlies c. Horse latitudes d. Polar Easterlies

5. What wind belt is letter D in? 5._____
a. Sub tropical low b. Calms c. Northeast Trades d. Polar Easterlies

TEST XI

Zones and Hemispheres

Another map--but this one is an easy one. The world is divided into zones and four hemispheres. Can you locate them? Select the correct answer and place the letter that goes with it on the line at the right.



1. What hemisphere is A located in? 1.______
   a. Northern b. Southern c. Eastern

2. What hemisphere is E in? 2.______
   a. Southern b. Western c. Eastern

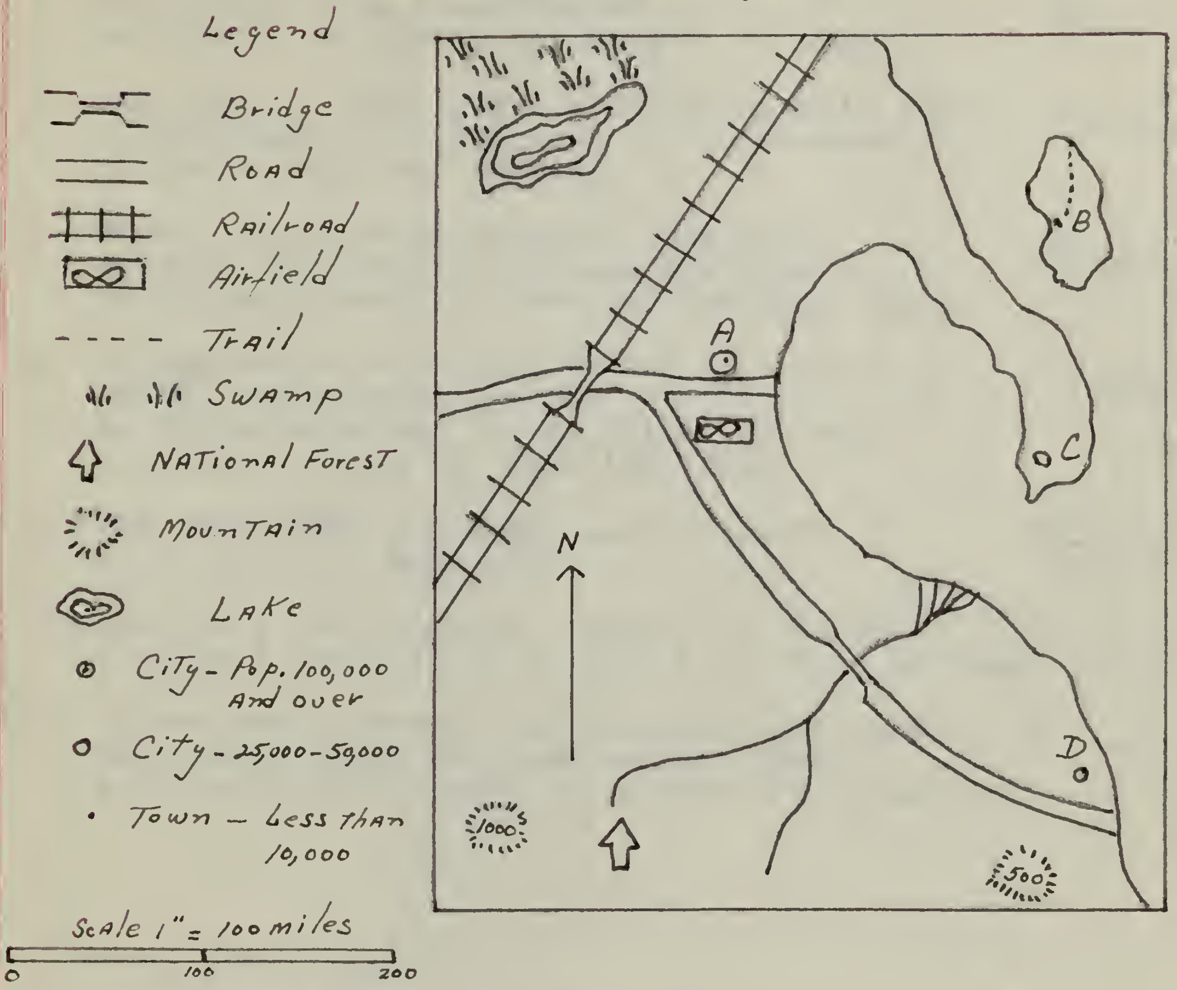
3. What zone is D in? 3.______
   a. Low b. Middle c. High

4. What zone is B in? 4.______
   a. Low b. Middle c. High

5. What zone is C in? 5.______
   a. High b. Low c. Middle

TEST XII

Use of Legend and Symbols



Going somewhere? You had better consult this map to make sure you know how to get there. Can you select the correct answer and place the letter of this correct answer on the line at the right.

1. What is the population of City A? 1._____
   a. 10,000 b. Over 100,000
   c. 50,000 d. Over 250,000

2. How many bridges are there on this map? 2._____
   a. 5 b. 1 c. 3 d. 2

3. Where would you look for an airport? 3._____
   a. Near city A b. Near city D
   c. Near city C d. No airport on this map

TEST XII (CONT.)

4. What city is on a peninsula? 4._____
a. City A b. City C c. City D d. Town B

5. How high is the highest mountain on this map? 5._____
a. 500 feet b. 9,000 feet c. 1,000 feet
d. There isn't any mountain

6. Where is the swamp found on this map? 6._____
a. Near the airport b. Near the lake
c. On the island d. Near the National Forest

7. If you and your friends wanted to explore a trail, where would you go? 7._____
a. On the mainland b. On the river delta
c. On the island d. Near the lake

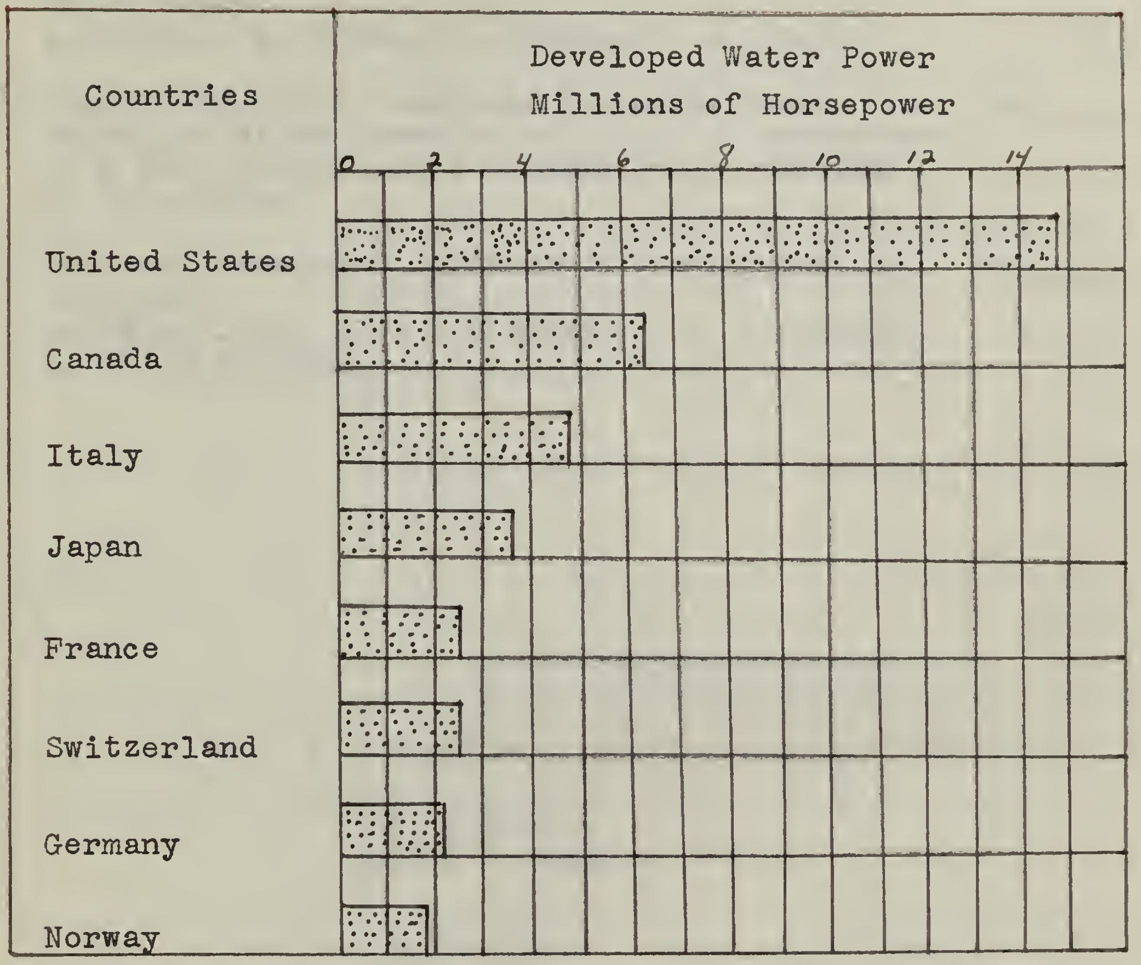
8. How many lakes are there on this map? 8._____
a. 3 b. 4 c. None d. 1

9. What city has strategic control of the gulf? 9._____
a. City A b. City D c. City C d. None of them

10. If you were a General in the Air Force what two places would you have bombed first? 10._____
a. B and C b. C and D c. A and C d. A and B

TEST XIII

Use of the Bar Graph



What are your plans? A successful career in business means ability to read graphs. Why not practice by selecting the correct answer and placing the letter of it on the line at the right.

1. What does this graph represent? 1._____
   a. Countries b. Developed water power
   c. Millions of horsepower

2. How much developed water power does the United States have in millions of horsepower? 2._____
   a. 10 million b. 2 million c. Almost 15 million
   d. 14 million

TEST XIII (CONT.)

3. Which country has the least amount of developed water power? 3._____
a. France b. Norway c. Germany d. Italy

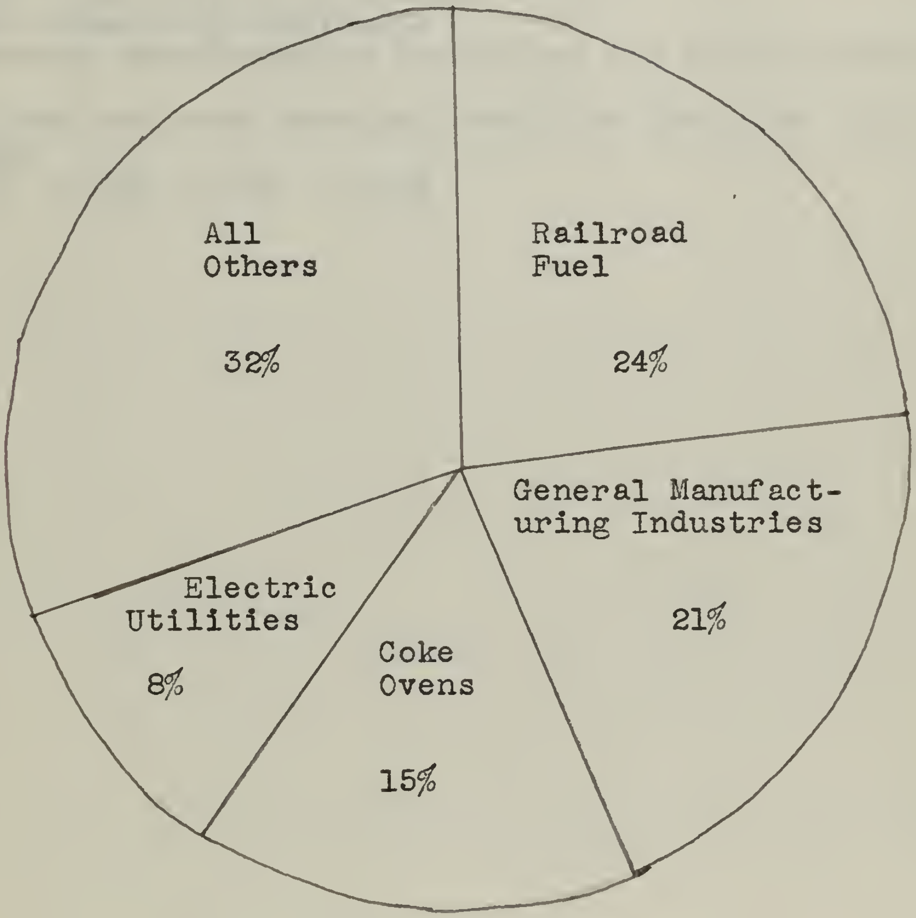
4. Canada and France combined have how much developed water power in millions of horsepower? 4._____
a. 8 3/4 million b. 6 million c. 2 million
d. 10 million

5. How much developed millions of horsepower has Germany? 5._____
a. 12 million b. 2 3/4 million c. 2 million
d. 1 1/2 million

TEST XIV

Circle Graph

There are many other ways of using coal besides burning it in the furnace. Test your knowledge by selecting the correct answer and placing the letter of it on the line at the right.



A graph showing the many different ways in which coal is used.

1. What does this graph represent? 1._____
   a. Uses of coal b. General manufacturing industries c. Railroads d. Coke ovens

2. Of the total uses of coal, what per cent is used as railroad fuel? 2._____
   a. 8% b. 15% c. 24% d. 32%

TEST XIV (CONT.)

3. What per cent of the total do Coke Ovens and Electric Utilities use together? 3._____
   a. 15% b. 8% c. 23% d. 100%

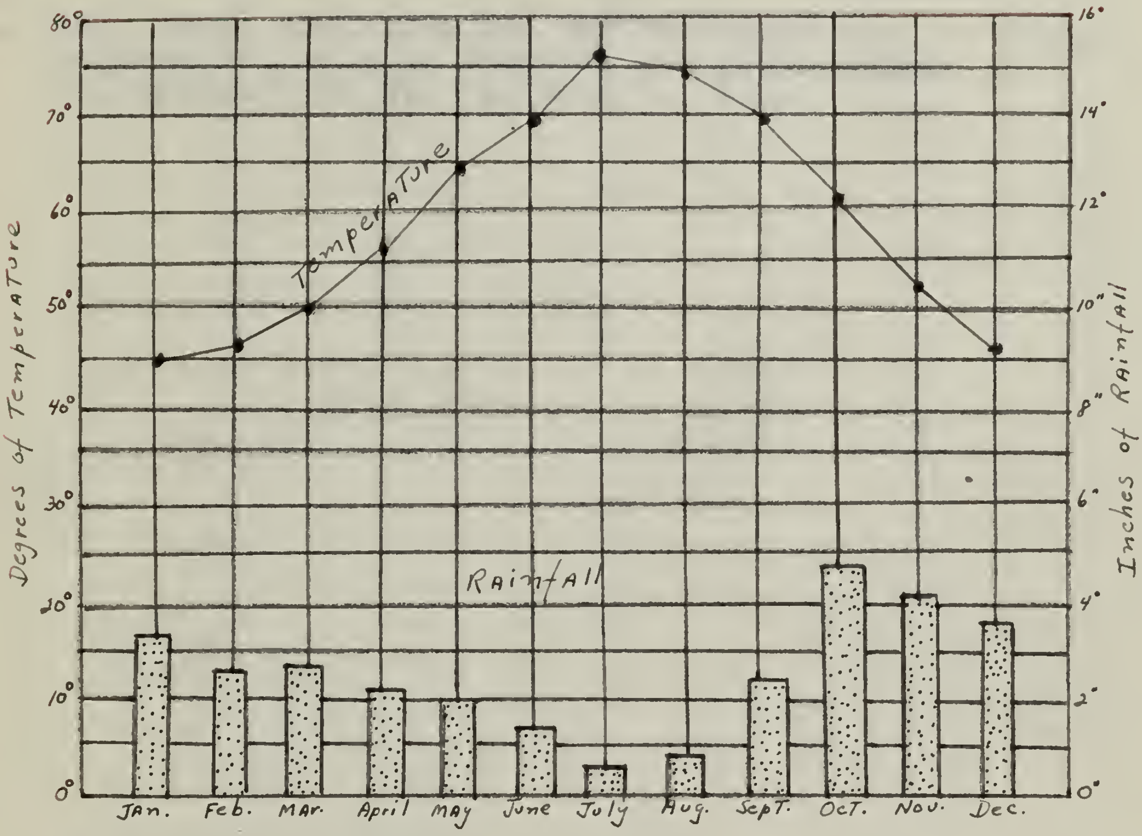
4. What two combined uses of coal consume more than 50% ? 4._____
   a. Electric Utilities and Coke Ovens
   b. All others and Railroads
   c. General Manufacturing Industries and Railroad Fuel

5. Railroad fuel used what per cent more than Coke Ovens? 5._____
   a. 3% b. 6% c. 9% d. 12%

TEST XV

Combination Line-Bar Graph

Temperature and Rainfall Graph



This graph represents the climate of a certain place. Would you enjoy vacationing at this unknown city? Find out by selecting the correct answer and placing the letter of it on the line at the right.

1. What is the warmest month? 1._____
   a. January b. September c. July d. August

2. What is the driest month? 2._____
   a. February c. July c. October d. August

3. What is the average temperature in April 3._____
   a. 76 degrees b. 40 degrees c. 51 degrees
   d. 57 degrees

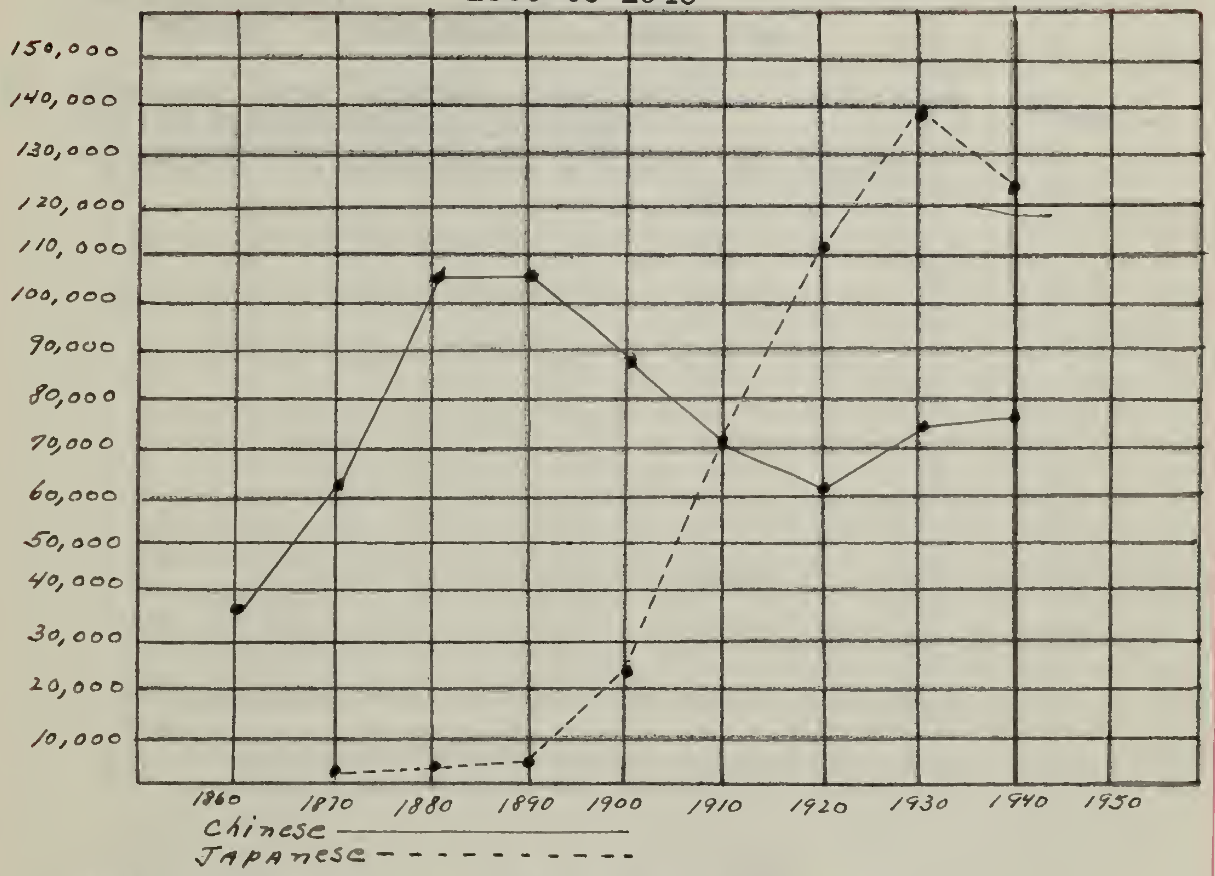
TEST XV (CONT.)

4. What is the average rainfall for the month of October? 4._____
   a. 1 inch b. 10 inches c. 5 inches d. 6 inches

5. What month would give you the best days for swimming? Plenty of sunshine and little rain. 5._____
   a. September b. May c. June d. July

TEST XVI

Chinese and Japanese Population in the United States
1860 to 1940



This graph introduces two of your neighbors. If you can read this graph it will tell you which group you are most likely to meet in a city in the United States. Place the letter which goes with the correct answer on the line at the right.

1. What population does the dotted line represent? 1._____
   a. Chinese b. Japanese c. Both

2. How many Japanese were there in the U. S. in 1930? 2._____
   a. 105,000 b. 150,000 c. Almost 140,000
   d. 143,000

3. In what year were there the same number of Chinese and Japanese in the United States? 3._____
   a. 1920 b. 1910 c. 1900 d. Never

TEST XVI (CONT.)

4. Did the Chinese or Japanese first come to the United States? 4._____
   a. Chinese b. Japanese c. Same time

5. How many more Japanese than Chinese were there in the United States in 1940? 5._____
   a. 10,000 b. 25,000 c. 100,000 d. 40,000

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CHAPTER IV

ANALYSIS OF THE TEST DATA

The following tables of data are compiled from the results of 371 tests given to 75 seventh grade pupils, 65 eighth grade pupils, 60 ninth grade pupils, 55 tenth grade pupils, 50 eleventh grade pupils, and 66 twelfth grade pupils. The pupils were not a homogeneous group. They represented the school population of the town of Swansea, Massachusetts. They came from varying types of environments, thus representative of all types of home background. Their I.Q.'s ranged from 59 to 146. Some of the high school students had taken the elective geography course given at the tenth grade level, while others had not been exposed to direct training on map skills since leaving the seventh grade.

The data has been treated in the following manner:

1. Validity established
2. Reliability established
3. Range of scores and I.Q.'s tabulated
4. The median, mean, and standard deviation of test scores and I.Q. scores computed.
5. Correlation between the I.Q. and test scores established.

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Establishing Validity

According to Green, Jorgenson, and Gerberich[1/] validity is the most important characteristic of a good examination, for unless a test is valid it serves no useful function. The validity of an examination depends upon the efficiency with which it measures what it attempts to measure.

In selecting the type of validity to be considered there was a choice of the three types: 1. curricular validity, 2. statistical validity, 3. psychological and logical validity. Of these three, the first is by far the most important, for in the final analysis any method of test validation must be based on relatively subjective judgments concerning the degree to which the test covers the proper ground. For this reason, the writer selected curricular validity as the method of validating the test. Sources that are used as evidence in concerning test validity are textbooks, courses of study, reports of national and regional committees, and writings of subject matter specialists. All of these sources were utilized in selecting the areas in map skills to be tested. Special emphasis was placed on the findings of authorities as outlined in the Thirty-Second Yearbook of the National Society for the Study of Education.[2/]

[1/] Green, Harry A., Albert N. Jorgenson, and J. Raymond Gerberich, Measurement and Evaluation in the Secondary School, Longmans, Green and Company, New York, 1948, pp. 52-61.

[2/] National Society for the Study of Education, Yearbook XXXII, The Teaching of Geography, Public School Publishing Company, 1938.

Establishing Reliability

In selecting a measure of reliability consideration had to be given to three correlation methods and one non-correlation methods.[1] The three correlation methods are the coefficient of reliability obtained by using the two forms of the test, the retesting coefficient, and the "chance-half" coefficient. The non correlation method involves the use of the Kuder Richardson Formula 21. Of these, the first was impossible as no alternate form of the test was made; the second was not considered adequate because of the possibility of familiarization with the test; and the third method of obtaining a correlation of reliability was partially adopted as comparisons were made after percentages of right answers were found for each item and for each grade. The Kuder Richardson Formula 21 proved sufficient for the purpose in this particular case and it was selected as the basis for estimating test reliability.

Greene, Jorgenson, and Gerberich[2] state this method of estimating test reliability furnishes a coefficient which may in some cases be an underestimate but which is never an overestimate of the reliability coefficient. The estimated reliability was .8607 using the Kuder Richardson Formula 21:

$$r_{tt} = \frac{n}{n-1} \times \frac{\sigma t^2 - n\,\bar{p}\,\bar{q}}{\sigma t^2}$$

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[1] Greene, Harry A., Albert N. Jorgenson, and J. Raymond Gerberich, Measurement and Evaluation in the Secondary School, Longmans, Green & Company, New York, 1948, p. 589-590.

[2] Ibid., p. 63.

The following tables are those of the individual items scored correctly by the pupils of grade seven through twelve and shown in the form of percentages.

TABLE I

PER CENT OF PUPILS ANSWERING EACH ITEM CORRECTLY BY GRADE LEVEL

Item	Gr. 7	Gr. 8	Gr. 9	Gr. 10	Gr. 11	Gr. 12
1	62.67	86.15	68.33	80.00	86.00	87.88
2	52.00	73.85	51.67	69.09	80.00	78.79
3	52.00	72.31	65.00	79.91	72.00	81.82
4	60.00	78.46	75.00	81.82	80.00	84.85
5	40.00	67.69	58.33	80.00	68.00	78.79
6	60.00	83.08	78.33	89.09	84.00	87.88
7	66.67	80.00	75.00	87.27	84.00	81.82
8	42.67	47.69	31.67	50.91	58.00	59.09
9	17.33	36.92	36.67	34.55	38.00	59.09
10	56.00	60.00	56.67	89.09	80.00	87.88
11	16.00	21.54	36.67	58.18	46.00	71.21
12	08.00	24.62	30.00	49.09	40.00	56.06
13	13.33	32.31	28.33	41.82	52.00	45.45
14	62.67	72.31	60.00	69.09	74.00	72.73
15	30.67	36.92	41.67	49.09	54.00	48.48
16	33.33	36.92	60.00	56.36	56.00	65.15
17	04.00	04.62	10.00	12.73	22.00	22.73
18	16.67	13.08	15.00	12.73	36.00	30.30
19	65.33	83.08	50.00	78.18	82.00	84.85
20	42.67	55.38	55.00	60.00	74.00	69.70

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TABLE I (CONT.)

Item	Gr. 7	Gr. 8	Gr. 9	Gr. 10	Gr. 11	Gr. 12
21	30.67	52.31	38.33	56.36	54.00	56.06
22	42.67	78.46	65.00	74.55	80.00	72.73
23	56.00	81.54	76.67	87.27	92.00	87.88
24	62.67	87.69	66.67	87.27	92.00	81.82
25	50.67	70.77	58.33	70.91	74.00	75.76
26	66.67	76.92	66.67	63.64	56.00	60.61
27	81.33	90.77	95.00	96.36	96.00	100.00
28	52.00	69.23	66.67	87.27	92.00	87.88
29	58.67	76.92	71.67	76.33	78.00	80.30
30	53.33	67.69	41.67	63.64	44.00	53.03
31	30.67	87.69	50.00	52.73	72.00	66.67
32	46.67	67.69	56.67	69.09	84.00	78.79
33	53.33	67.69	51.67	76.36	74.00	71.21
34	36.00	60.00	41.67	70.91	68.00	65.15
35	46.67	63.08	46.67	81.82	82.00	75.76
36	38.67	58.46	36.67	50.91	56.00	51.52
37	14.67	16.92	21.67	18.18	22.00	40.91
38	45.33	41.54	55.00	65.45	66.00	65.15
39	22.67	24.62	36.67	36.36	46.00	56.06
40	60.00	60.00	56.57	49.09	60.00	54.55

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TABLE I (CONT.)

Item	Gr. 7	Gr. 8	Gr. 9	Gr. 10	Gr. 11	Gr. 12
41	38.67	63.08	38.33	58.18	72.00	65.15
42	48.00	70.77	45.00	72.73	80.00	68.18
43	53.33	80.00	66.67	85.45	84.00	77.27
44	53.33	72.31	65.00	78.18	86.00	72.73
45	53.33	73.85	71.67	50.91	80.00	83.33
46	34.67	40.00	43.33	76.36	48.00	48.48
47	36.00	49.23	46.67	45.45	78.00	78.79
48	37.33	46.15	45.00	67.27	70.00	75.76
49	18.67	32.31	26.67	61.82	42.00	45.45
50	18.67	41.54	33.33	50.91	58.00	48.48
51	59.33	50.77	50.00	52.73	54.00	53.03
52	48.00	47.69	61.67	65.45	66.00	71.21
53	60.00	60.00	70.00	72.73	72.00	74.24
54	28.00	27.69	51.67	27.27	32.00	34.85
55	37.33	15.38	48.33	58.18	42.00	63.64
56	77.33	72.31	71.67	80.00	80.00	86.36
57	64.00	67.69	75.00	69.09	68.00	74.24
58	20.00	32.31	26.67	41.82	34.00	45.45
59	36.00	24.62	38.33	47.27	40.00	53.03
60	94.67	70.77	93.33	83.64	92.00	80.30

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TABLE I (CONT.)

Item	Gr. 7	Gr. 8	Gr. 9	Gr. 10	Gr. 11	Gr. 12
61	81.33	86.15	86.67	92.73	100.00	90.90
62	82.67	95.38	91.67	96.96	96.00	89.39
63	80.00	89.23	96.67	98.18	98.00	96.97
64	62.67	72.31	71.67	80.00	88.00	80.30
65	85.33	89.23	83.33	94.55	100.00	87.88
66	81.33	95.38	95.00	100.00	98.00	93.94
67	70.67	80.00	73.33	81.82	78.00	87.88
68	92.00	93.85	88.33	100.00	100.00	96.97
69	48.00	60.00	71.67	69.09	72.00	77.27
70	53.33	69.23	68.33	85.45	64.00	56.06
71	56.00	75.38	70.00	74.55	66.00	69.70
72	64.00	67.69	30.00	80.00	64.00	74.24
73	93.33	96.92	86.67	98.18	98.00	95.45
74	81.33	89.23	30.00	81.82	94.00	87.87
75	85.33	78.46	88.33	85.45	84.00	95.45
76	81.33	81.54	91.67	94.55	100.00	95.45
77	93.33	98.46	98.33	100.00	100.00	96.97
78	73.33	92.31	91.67	92.73	98.00	96.97
79	80.00	90.77	91.67	94.55	100.00	96.97
80	70.67	96.92	88.33	87.27	98.00	89.39

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TABLE I (CONT.)

Item	Gr. 7	Gr. 8	Gr. 9	Gr. 10	Gr. 11	Gr. 12
81	78.67	95.38	91.67	100.00	98.00	93.94
82	65.33	90.77	76.67	94.55	98.00	96.97
83	61.33	78.46	81.67	83.64	88.00	92.42
84	72.00	86.15	81.67	98.18	92.00	93.94
85	69.33	95.38	85.00	96.36	94.00	86.36
86	68.00	93.85	83.33	100.00	92.00	90.91
87	76.00	95.38	90.00	98.18	98.00	93.94
88	62.67	78.46	73.33	89.09	76.00	80.30
89	62.67	83.08	85.00	81.82	98.00	89.39
90	56.00	73.85	86.67	83.64	98.00	86.36

Range of Scores and I.Q.'s Tabulated

In the following six tables the range of scores and I.Q.'s are tabulated by grade. These tables indicate the comparison that can be made between scores and I.Q.'s. All I.Q.'s are the scores obtained on the Henmon-Nelson Test of Mental Ability.

The results of the Pearson product-moment coefficient of correlation are shown at the bottom left hand side of the tables.

TABLE IIA

RANGE OF SCORES AND I.Q.'S IN THE SEVENTH GRADE

Score \ I.Q.	50-59	60-69	70-79	80-89	90-99	100-109	110-119	120-129	130-139	140-149	f
79-77									1	1	2
76-74						1					1
73-71							1				1
70-68					1			1			2
67-65					2	2			1		5
64-62						2					2
61-59							1				1
58-56			1	3	1		1				6
55-53					2	4	1				7
52-50				1	3	2	1				7
49-47						2					2
46-44			1	2	3	1		1		1	9
43-41				2	3	1					6
40-38			4	3	2	1					10
37-35		1	1		1						3
34-32		1		2	1						4
31-29	1	1	3	2							7
28-26											0
											75

Coefficient of correlation .6490

TABLE IIB

RANGE OF SCORES AND I.Q.'S IN THE EIGHTH GRADE

I.Q.	70-79	80-89	90-99	100-109	110-119	120-129	130-139	frequency
Score								
79-77				1	1		1	3
76-74						2		2
73-71				3	1	1	1	6
70-68		1	1	2		1		5
67-65	1			2	2	2		7
64-62			3	2				5
61-59			5	1	2	1		9
58-56		1	1	4				6
55-53		1	1	1				3
52-50	1	1	2	3	1			8
49-47	2	3						5
46-44		1						1
43-41		2						2
40-38	1							1
37-35	1		1					2
34-32								0
31-29								0
								65

Coefficient of correlation .6612

TABLE IIC

RANGE OF SCORES AND I.Q.'S IN THE NINTH GRADE

I.Q.	60-69	70-79	80-89	90-99	100-109	110-119	120-129	130-139	140-149	f
Score										
82-80						2	1	1		4
79-77						1				1
76-74					1	1				2
73-71									1	1
70-68					3	2				5
67-65					5	1		1		7
64-62				1			1			2
61-59				2	3	1	2			8
58-56			1	1	2	1				5
55-53				1		1				2
52-50			1	1						2
49-47			4	3	1	1				9
46-44		1		1						2
43-41			2		1					3
40-38			1			1				2
37-35			1	1						2
34-32	1									1
31-29		1								1
28-26		1								1
										60

Coefficient of correlation .7156

TABLE IID

RANGE OF SCORES AND I.Q.'S IN THE TENTH GRADE

I.Q. Score	80-89	90-99	100-109	110-119	120-129	130-139	140-149	frequency
82-80			1	1				2
79-77			1	3	2		1	7
76-74		2			2			4
73-71	1	1	2	1				5
70-68		1	5		2			8
67-65			1	2				3
64-62		5	1					6
61-59			3					3
58-56		3	2					5
55-53		2	1					3
52-50								0
49-47		3	1					4
46-44			1					1
43-41		3						3
40-38				1				1
								55

Coefficient of correlation .4653

TABLE IIE

RANGE OF SCORES AND I.Q.'S IN THE ELEVENTH GRADE

I.Q.	70-79	80-89	90-99	100-109	110-119	120-129	130-139	140-149	frequency
Score									
85-83							1		1
82-80			1	1	1	2		1	6
79-77						2			2
76-74			1	3	2	1	1		8
73-71			1			1			2
70-68			1	2					3
67-65		2	3	1	1				7
64-62				1	2	1			4
61-59						1			1
58-56		2	1	2					5
55-53	1	3							7
52-50			2						2
49-47									0
46-44		1							1
43-41			1						1
									50

Coefficient of correlation .6016

TABLE IIF

RANGE OF SCORES AND I.Q.'S IN THE TWELFTH GRADE

I.Q.	80-89	90-99	100-109	110-119	120-129	frequency
Score						
88-86				1		1
85-83				1		1
82-80		1	1	3	1	6
79-77		1	1	2	3	7
76-74				3	1	4
73-71		1	5	1		7
70-68			6			6
67-65	2	3	5			10
64-62	1	3	3			7
61-59		2	1			3
58-56	3	3				6
55-53	1					1
52-50			1			1
49-47	1	1	1			3
46-44			1			1
43-41	1					1
40-38			1			1
						66

Coefficient of correlation .6148

Computation of the Median, Mean, and Standard Deviation of Test Scores and I.Q. Scores

The central tendency is indicated by the median and arithmetic mean. Some evidence of maturity influencing the results of this test is shown by a study of these two measures. The seventh grade has the lowest central tendency and with the exception of the ninth grade which has a slightly lower median and mean than the eighth grade, the averages increase with the grades. The twelfth grade has the highest grouping of scores.

It is apparent that a measure of central tendency can describe only one of the important characteristics of a distribution, and that it is equally essential to know how compactly the measures are distributed about this point of central tendency, or, how far they are scattered from it. For this purpose the standard deviation of test scores and intelligence test scores were computed.

Table III compares the median, mean, and standard deviation of the results achieved by each grade.

TABLE III

MEDIAN, MEAN, AND STANDARD DEVIATION OF SCORES ON THE EDGAR GEOGRAPHY TEST AND THE HENMON-NELSON TEST OF MENTAL ABILITY

	Edgar Geography Test			Henmon-Nelson Test of Mental Ability		
Grade	Median	Mean	S.D.	Median	Mean	S.D.
7	45.99	48.35	12.49	93.97	94.53	17.67
8	60.00	59.53	10.36	100.82	100.64	15.28
9	58.50	57.00	13.26	102.63	102.17	15.85
10	66.00	64.09	11.30	102.92	104.86	11.44
11	66.21	66.06	11.05	103.34	104.90	15.70
12	67.50	66.95	10.62	103.00	102.68	11.01

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[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Establishing the Correlation Between the I.Q.'s and the Test Scores

The Durost-Walker Correlation Chart Method was used to obtain the Pearson product-moment coefficient of correlation. The results obtained were as follows:

Grade	Correlation
7	.6490
8	.6612
9	.7156
10	.4653
11	.6016
12	.6148

It is significant to note that the lowest correlation between I.Q. and test scores was found at the tenth grade level and the highest correlation at the ninth grade level. This possibly could be due to the fact that geography which includes map skills is taught at the tenth grade level. On the other hand the ninth graders have not had direct work with map skills since their departure from the seventh grade. This situation may be peculiar to the Swansea School System and may not be true in other systems.

CHAPTER V

SUMMARY

1. The test measures objectively the skills necessary to read maps.
2. The skills are within the ability of the groups tested.
3. The scores ranged from a high of 87 to a low of 26.
4. The group showed definite weaknesses in the following areas:

    a. Tests III and IV

    Recognition of direction at the poles

    b. Tests VII and VIII

    1. Use of latitude and longitude
    2. Ability to use longitude to tell time
    3. Ability to use the International Date Line

    c. Test IX

    Degrees of latitude and longitude

5. The group experienced some difficulty with these areas:

    a. Test V and VI

    Use of the scale (the factor of arithmetic may have entered into this area)

    b. Test X

    The wind belts

    c. Test XI

    Zones and hemispheres

6. The group demonstrated marked strength in the following areas:

    a. Test I

    Recognition of direction on a Mercator projection

    b. Test XII

    Use of legends and symbols

    c. Tests XIII, XIV, XV, AND XVI

        1. Use of the bar graph
        2. Use of the circle graph
        3. Use of the combination line-bar graph
        4. Use of the line graph

    The skills in this area indicated mastery. This in part may be due to the close correlation with arithmetic skills in relation to graphs.

7. It is evident that many skills, especially on certain types of projections, have not been taught. Pupils revealed more ability on the better known projections such as the Mercator. Their performance on polar maps was poor, showing unfamiliarity with this type of map.

8. The results indicate that I.Q. has some bearing on performance but more testing needs to be done to prove it a significant factor.

9. This test indicated that maturation is a significant factor. The highest score of 87 in the twelfth grade was eight points higher than the score of 79 achieved in the seventh grade. There was a consistent growth in the highest score attained by each grade.

10. The results indicate a lack of teaching of map skills. It appears that much learning on these skills is incidental.

Suggestions for Further Research

1. The test should be revised, then administered to an equal number of pupils from grades seven, eight, nine, ten, eleven, and twelve. Children from different schools and from various communities would give a better sampling of the school population.
2. The validity of test items could be computed by making an item analysis.
3. The abilities of boys could be compared with those of girls.
4. The test could be standardized.
5. The test could be administered minus the tests on graphs and a comparison made with the median, arithmetic mean, and standard deviation made on the test.
6. The test could be split into two parts. One part would be administered at the beginning of the year, the other part at the end of the year. This would give a measure of progress.

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APPENDIX

DIRECTIONS FOR ADMINISTERING TEST

1. This diagnostic map test is a complete unit compiled in booklet form.
2. The Superintendent of Schools has given his permission to have this test administered in one sitting.
3. Pass out one booklet to each pupil.
4. Have the students read the front page.
5. Have the students turn to page one and fill out the blanks.
6. Turn to page two and do the sample questions with the pupils being sure that they all know where to put the answers. Each question is numbered on the left hand side and the answer space has a corresponding number on the right hand side. Answers to all questions will be found on the map or graph. The map or graph must be examined in order to answer the questions.
7. See that all pupils have a ruler. Answer any questions about the test before it begins.
8. When the examiner is sure all pupils are ready say, "Turn to page three and begin."
9. There is no time limit on this test.
10. Collect all booklets when finished.

DIRECTIONS FOR SCORING

1. There is only one correct answer for each question.
2. All blank spaces in the answer column are considered as being wrong.
3. Add up the correct answers for each sheet and place the total at the bottom of each page.
4. When the test is all corrected, fill in the pupil's score for each test on page one of the booklet.
5. Add up the pupil's total score and place it in the correct space.

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